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ASSEMBLY FOR UNFOLDING FLATTENED CARTONS IN PACKAGING
MACHINERY ;

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ABSTRACT:

Flattened cartons or containers stacked in a hopper of a packaging machine are successively removed from the hopper by an extractor including a vertically reciprocable suction-cup carrier engageable with the bottom section of the lowermost carton in the stack which initially is coplanar with an adjoining lateral section. The latter section, during the descent, comes to rest against a stationary ramp; the incipient erection of that lateral section by its engagement with the ramp is accelerated by a pair of swingable arms flanking the ramp, these arms being pivoted into a vertical position for area contact with the side of the passing carton. Possible malfunctions can be detected by a pressure sensor communicating with the suction line or by a photosensor in line with an area occupied by an end section of the carton in the unfolded position thereof.

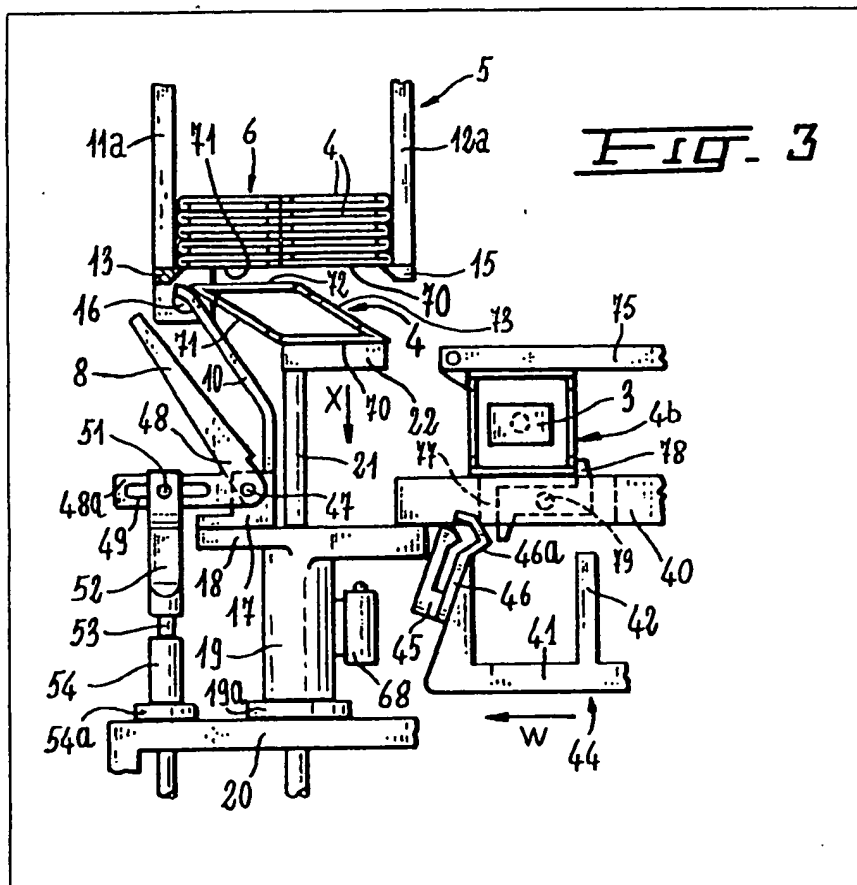
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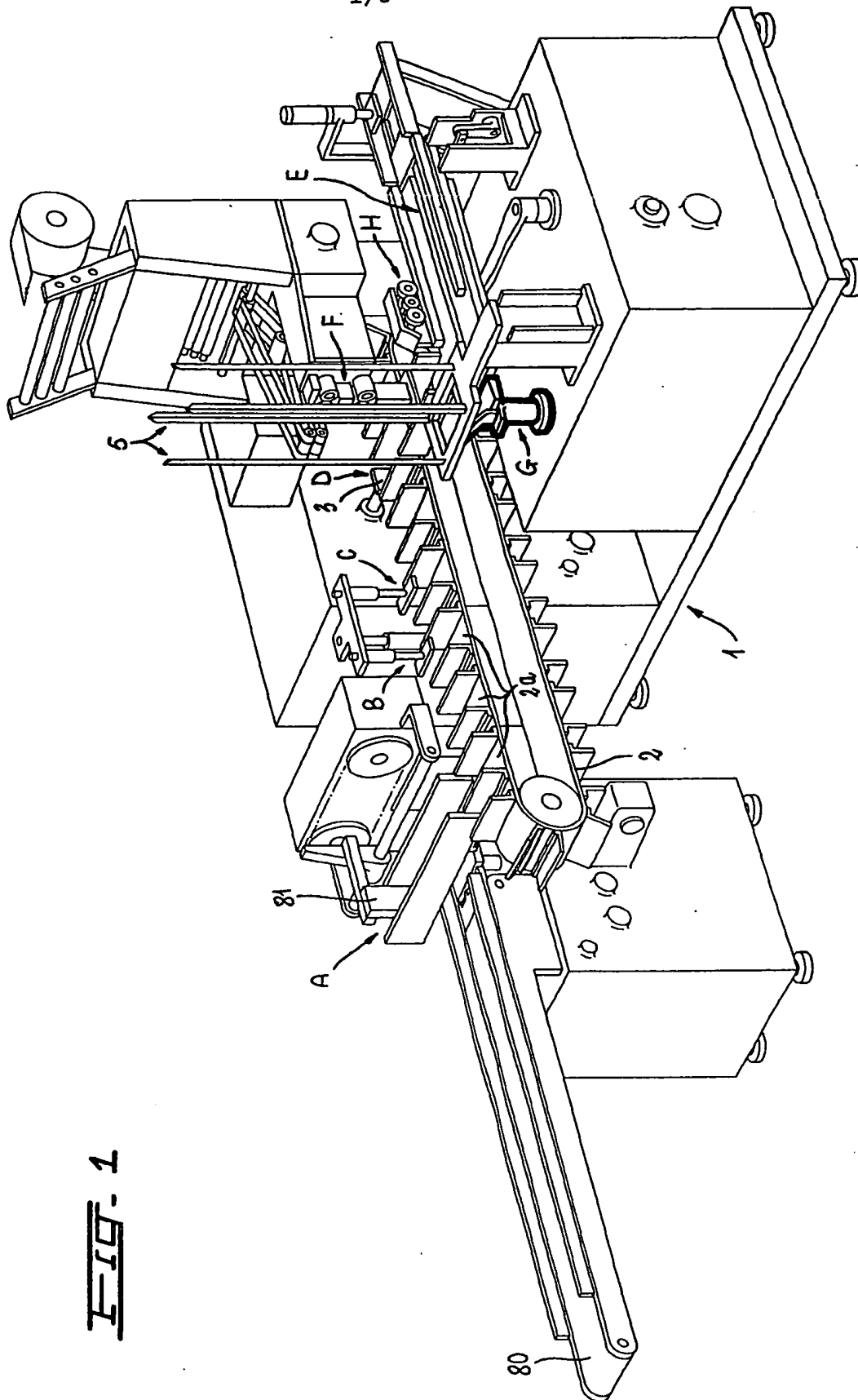
(54) Erecting flattened tubular cartons

(57) Flattened cartons stacked in a hopper 5 of a packaging machine are successively removed from the hopper by an extractor including a vertically reciprocable suction-cup carrier 22 engageable with the bottom section 70 of the lowermost carton in the stack which initially is coplanar with an adjoining lateral section 71. The latter section, during the descent, comes to rest against a stationary ramp 10; the incipient erection of that lateral section by its engagement with the ramp is accelerated by a pair of swingable arms 8 flanking the ramp, these arms being pivoted into a vertical position for area contact with the side of the passing carton. Possible malfunctions can be detected by a pressure sensor commu-

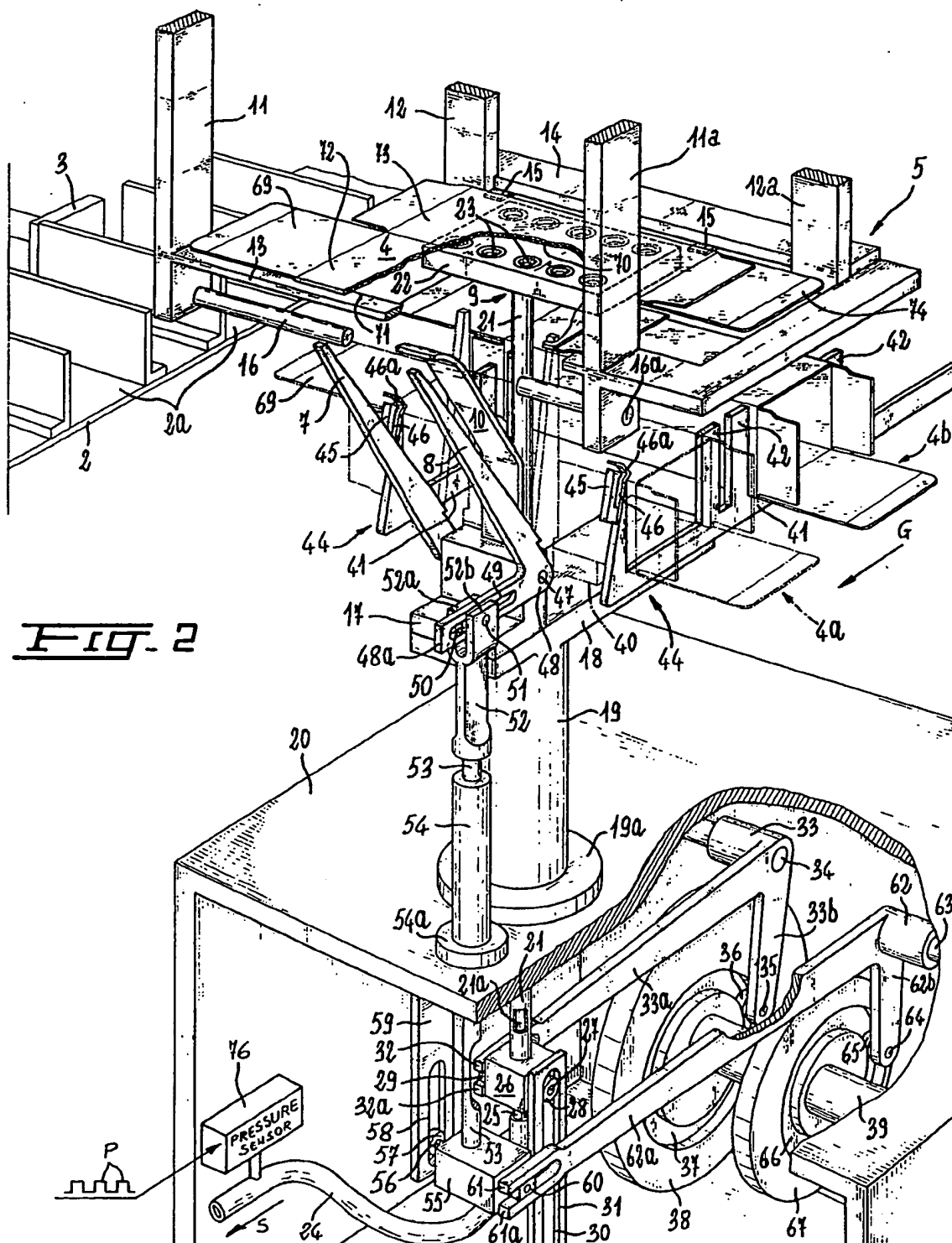
nicating with the suction feed line of the carrier by a photosensor 68 in line with an area occupied by an end section of the carton in the unfolded position thereof. A comb 44 movable in a vertical rectangular path transfers an erected carton between support plates 40, 75 at which the carton is loaded through an end by a pusher 3.



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Ex-1



SPECIFICATION

Unfolding flattened cartons

- 5 The present invention relates to a device for the unfolding of flattened cartons or containers as used in packaging machinery in which such cartons are stacked in a hopper and, after unfolding, are loaded with articles inserted endwise from, say, an adjacent conveyor.

- The cartons here considered are four-sided containers with bottom, top and lateral sections interlinked by parallel fold lines
- 15 whereby, in their flattened state, one lateral section is coplanar with the bottom section and is overlain by the top section which in turn is coplanar with the other lateral section overlying the bottom section. During each
- 20 operating cycle of the packaging machine, an extractor underneath the hopper engages the bottom section of the lowermost carton of the stack with the aid of vertically reciprocable suction means and, in a descending stroke,
- 25 withdraws that carton from the hopper past an adjacent deflector which engages an adjacent lateral section for erecting same. This motion expands the flattened carton into its unfolded state facilitating an endwise introduction of
- 30 the goods to be packaged.

- In a prior assembly of this sort, the deflector has a stationary ramp lying in the path of descent of an edge of the carton constituted by the fold line linking the adjacent lateral
- 35 section with the top section thereof. As that edge is being cammed inward by the sloping ramp surface, a position is soon reached in which that lateral section lies flat against the ramp whereupon the zone of contact shifts
- 40 instantaneously from the upper to the lower part of the ramp, with resulting foreshortening of the moment arm and a change in the angle of attack subjecting the carton to undesirable vertical stress components. This, especially
- 45 with high-speed operation, may have a damaging effect upon the workpieces.

- The general object of our present invention, therefore, is to provide an improved assembly for unfolding flattened cartons or containers, extracted from a hopper in the aforescribed manner, which obviates this drawback and allows a packaging machine so equipped to operate at a higher rate of production.

- In accordance with the present invention there is provided a method of unfolding and erecting a flattened carton having a first lateral section coplanar with a bottom section, a top section overlying the first lateral section and a second lateral section overlying the
- 60 bottom section, the sections being joined by parallel fold lines, and the method comprising drawing the bottom section vertically downwards such that the first lateral section engages a vertically inclined fixed deflector to
- 65 progressively urge the first lateral section to-

- ward an upright position, and swinging a pivotable deflector from a first retracted position to a second upright position relative to the fixed deflector to engage the first lateral section and to complete the movement of that section into its upright position.

- The fixed deflector preferably comprises a stationary ramp, the pivotable deflector being pivotable about an axis parallel to the fold lines of the carton and being synchronised with the vertical draw-down means. In its upright position the pivotable deflector lies closely adjacent the path of descent of the fold line linking the bottom section with the
- 80 first lateral section of the carton. The pivotable member preferably comprises two interconnected arms flanking the stationary ramp, and it preferably disengages the first lateral section from the ramp face before this section has
- 85 come into full contact with that face. Its pivotal motion positively displaces the entire carton into its unfolded or expanded state without further camming action.

- Generally a carton of the type here considered also has two end sections constituting of a single section or of two different sections of the group previously referred to, these end sections being separately foldable to close the carton or container after it has been loaded.
- 95 When a carton pulled from the hopper by the extractor is unfolded, an end section extending from either the top section or the second lateral section of the container body will move away from the other two body sections so as
- 100 to occupy a position remote therefrom. If, for any reason, the extracted carton fails to unfold, such malfunction can be detected by a photosensor aligned with the unfolded position of that end section in accordance with
- 105 another feature of our present invention.

- By way of example only, an embodiment of the invention will now be described in detail with reference to the accompanying drawings in which:

- 110 *Figure 1* is a perspective view of a packaging machine embodying our invention;

- Figure 2* is a perspective view, drawn to a larger scale, of an unfolding assembly included in the machine of *Fig. 1*;

- 115 *Figures 3 and 4* are side elevational views of the unfolding assembly in two different operating positions; and,

- Figure 5* is a view similar to *Fig. 3*, illustrating an irregular position of a carton withdrawn
- 120 from a hopper or stacking tube by the assembly of *Figs. 2-4*.

- Fig. 1* shows a packaging machine 1 whose principal components include a conveyor 2 with compartments 2a designed to receive
- 125 articles to be inserted into respective cartons. These articles, which could be in the form of blister packages, arrive on a conveyor 80 at a feeding station A here shown to comprise a pusher 81 serving to insert one or more of
- 130 these packages during a given machine cycle

into a conveyor compartment concurrently aligned therewith. In lieu of such a feeder we might also use an unstacker retrieving the packages from a hopper as disclosed in our
 5 pending application serial number 82 03115 filed 3 February 1982. The intermittently advancing conveyor 2 transports the articles past two checking stations B and C which determine, eg photoelectrically as
 10 known *per se*, the presence of a blister package in each compartment and the proper filling of such a package. The articles next arrive at a transfer station D where a pusher 3 thrusts them out of their compartments
 15 through a labelling station F and into respective cartons 4 (Figs. 2-5) extracted from a hopper 5 or magazine in which these cartons are stacked in folded state as more fully described hereinafter.

20 The extraction, unfolding and loading of the cartons is accomplished by an assembly G, shown in heavier lines since it embodies the present invention, from which the loaded cartons pass over a track E underneath a printer or labeller H to a non-illustrated further destination for sealing and ultimate removal from the machine.

As more particularly illustrated in Fig. 2, assembly G comprises a pair of parallel arms
 30 7, 8 which are rigidly interlinked by a shaft 47 transversing a block 17 atop a mounting plate 18; this plate is integral with a column 19 mounted by flange 19a on a stationary machine housing 20. Arms 7 and 8 flank a
 35 ramp 10 which rises from block 17 and adjoins an extractor 9 disposed underneath a hopper or stacking tube 5. The latter comprises a first pair of uprights 11, 11a and a second pair of uprights 12, 12a which serve
 40 for the guidance of flattened cartons 4 piled into a stack 6 (Figs. 3-5). Each flattened carton consists of two layers of cardboard or the like, each layer comprising two body sections and one end section. More particularly,
 45 the lower layer includes a bottom section 70, a first lateral section 71 and an end section 74 extending from section 70 whereas the upper layer includes a top section 72, a second lateral section 73 and an end section
 50 69 extending from section 72. Each carton also has foldable flaps to be pasted onto its end sections when the latter are turned into vertical position for sealing the loaded carton. Uprights 11 and 11a are interconnected by a
 55 shelf 13 supporting sections 71, 72 and 69 of the lowermost carton of the stack while the remaining sections rest on short lugs 15 which project from a bar 14 interconnecting the uprights 12, 12a. Upright 11, which
 60 together with upright 12 is disposed in the vicinity of conveyor 2, further supports a horizontal deflecting rod 16 underlying the shelf 13 and extending toward ramp 10; a similar rod 16a aligned with rod 16 is sup-
 65 ported by upright 11a. The two rods 16 and

16a are separated from ramp 10 by clearances sufficient to let the arms 7 and 8 swing past.

Extractor 9 comprises a shaft 21 which
 70 slides inside column 19 and forms a channel 21a terminating underneath a cross-head 26 in a nipple 25 by which this shaft can be coupled to a flexible hose 24 connected to an intake end of a suction pump as schematically
 75 indicated by an arrow S. The upper end of shaft 21 supports a plate 22 with suction cups 23 connected to channel 21a, plate 22 being aligned with the bottom section 70 of the lowermost carton of the stack 6 but being
 80 offset from the adjoining lateral section 71.

The cross-head 26 is traversed by a horizontal bolt 27 carrying at one end an idler roller 28 and at its other end a slider 29 straddled by prongs 32, 32a of a bifurcate extremity of
 85 an arm 33a of a lever 33 pivoted on a stud 34 within housing 20. Another arm 33b of lever 33 carries on its free end a pin 35 with a cam follower in the form of another idler roller 36 received in an eccentric groove 37
 90 of a cam disk 38 which is mounted on a motor-driven shaft 39. Roller 28 is guided in a vertical slot 30 of a fixed plate 31.

Mounting plate 18 is rigid with a horizontal platform 40 acting as a support for an un-
 95 folded carton engaged by a comb-shaped transporter 44 which comprises a pair of parallel horizontal bars 41, 41 with upstanding teeth 42 forming pockets 43 (Fig. 4) for the reception of such a carton; in Fig. 2 I
 100 have shown in phantom lines the position 4a of a carton 4 received in a first pocket and in full lines the position 4b of another carton received in a second pocket of the transporter whose operation will be more fully described
 105 hereinafter. The tooth 42 on the end of each bar proximal to column 19 carries a detent 45 with a resilient tongue 46 forming a catch 46a which serves to retain an engaged carton in the first pocket before that carton reaches
 110 the position 4b where it is overlain by a shelf 75.

The swingable arm 8 is part of a lever 48 which has another arm 48a provided with a slot 49. A slider 50 in slot 49 is mounted on
 115 a pin 51 transversing prongs 52a, 52b of an upper extremity 52 of a shaft 53 which is guided in a sleeve 54; this sleeve rises alongside column 19 from the top of housing 20 to which it is secured by a flange 54a. The lower
 120 end of shaft 53 is connected to a cross-head 55 traversed by a bolt 56 which supports at one end an idler roller 57 and at its opposite end a slider 60. Roller 57 is received in a vertical guide slot 58 of a fixed plate 59
 125 within housing 20, slider 60 is received between prongs 61 and 61a of a bifurcate extremity of an arm 62a forming part of a lever 62 which is fulcrumed on a stud 63 parallel to stud 34. Another arm 62b of lever
 130 62 carries at its free end a pin 64 with a cam

follower in the form of an idler roller 65 received in an eccentric groove 66 of a disk 67 also mounted on the driven shaft 39.

As shown in Figs. 3-5, column 19 carries a
5 photosensor 68 in a position in which it is aligned with the end flap 69 of a properly unfolded carton 4 extracted from hopper 5. The photosensor is illuminated by a light source (not shown) above the level of the
10 unfolded end flap 69 but is activated only during part of each operating cycle by an enabling pulse P from a nonillustrated timer. Such enabling pulses P are also fed to a pressure sensor 76 which, as shown in Fig. 2,
15 is mounted in housing 20 and is connected to suction hose 24 in order to determine whether the bottom section 70 of a carton 4 has been properly drawn onto the suction cups 23 of extractor plate 22.

20 We shall now describe the operation of the assembly shown in Figs. 2-5.

At the beginning of an operating cycle, slave cam 37, 38 causes the lever 33 to
elevate the shaft 21 whereby suction plate 22
25 comes into contact with the bottom section 70 of the lowermost carton 4 of the stack 6. The suction of cups 23 aspirates that section into contact with plate 22 whereupon the plate begins its descent as indicated in Fig. 3
30 by an arrow X. At the beginning of this descent the overhanging edge of lateral section 71, linked by a fold line with top section 72, comes into contact with rods 16, 16a and, substantially at the same time, with the
35 top of ramp 10 whereby the carton 4 begins to assume a parallelogrammatic profile as seen in Fig. 3. Slave cam 66, 67 now causes the lever 62 to swing clockwise (Fig. 2) whereby shaft 53 is raised (arrow Y, Fig. 4)
40 and imparts a similar pivotal motion to the swingable member consisting of arms 7 and 8. These arms thereupon swing past the ramp 10 into an upright position, shown in Fig. 4, in which their working surfaces lie close to the
45 confronting edge of plate 22 in a vertical plane corresponding to the path of descent of the fold line between sections 70 and 71. This results in the erection of lateral section 71 and in a corresponding motion sections 72
50 and 73 whereby the carton assumes a square or rectangular profile while approaching the position 4a referred to in connection with Fig. 2.

Transporter 44 is intermittently advanced in
55 a clockwise loop by a nonillustrated linkage coupled with the machine drive which shifts its first pocket at a lower level, according to an arrow W shown in Fig. 3, from a location aligned with container position 4b to a location underlying container position 4a whereupon the transporter is elevated as indicated by
60 an arrow Z (Fig. 4) to engage the extracted and unfolded carton. At its elevated level, seen in Fig. 2, transporter 44 then moves that
65 carton to position 4b underneath shelf 75

where the carton is aligned with pusher 3 and with a compartment 2a of the momentarily arrested conveyor 2, the pusher then advancing to load the carton with the contents of
70 that compartment through the open end overhung by section 69. The carton-supporting platform 40 is provided with a cutout 77 accommodating a detent 78, pivoted to it at 79, which holds the carton in place during
75 the subsequent descent of the transporter 44 to the level shown in Fig. 4. In the next cycle a ledge (not shown) spanning bars 41, 41 of the rising transporter engages the detent 78 and releases the loaded carton in position 4b
80 which thus can now be pushed farther to the right by an adjoining tooth 42 as the next carton is being moved into its place from position 4a. In each cycle, therefore, a number of cartons are advanced by the transporter
85 44 over platform 40, forming part of the track E of Fig. 1, past printing station H toward the end of that track for sealing and discharge from the machine.

The catch 46a of detent 45 is readily
90 cammed aside when the transporter 44 rises to receive in its first pocket the unfolded carton in position 4a. After that carton has been shifted into position 4b underneath shelf 75, the catch also yields to let the transporter
95 descend to its lower level.

The aforementioned timer also controls the application of suction to the cups 23 of plate 22 so as to release the extracted carton as soon as it is bracketed by the transporter teeth
100 in position 4a. Prior to that release, i.e. during the descent of the carton from the stack 6 to the position of Fig. 4, pressure sensor 76 of Fig. 2 is enabled by a pulse P to detect the possible absence of an engaged carton in
105 which case the air pressure in hose 24 would be at a near-atmospheric level rather than at the low level normally created by the pump. Upon detecting such a malfunction, sensor 76 would emit an alarm signal and/or arrest the
110 machine.

As illustrated in full lines in Fig. 5, a carton extracted from the hopper might on occasion fail to open into the parallelogrammatic shape represented in phantom lines. End flap 69
115 (Fig. 2), being coplanar with top section 72, would in that instance remain substantially in line with lateral section 71 instead of approaching the horizontal position of the top section shown in Fig. 4. In such a case the
120 photosensor 68, during its enablement by a pulse P, would be illuminated by the associated light source and would therefore also emit a signal alerting the operator and/or arresting the machine.

125 Practical tests have shown that a packaging machine equipped with an assembly as disclosed in Figs. 2-5 can have a much higher output rate than one of conventional construction.

130

CLAIMS

1. A method of unfolding and erecting a flattened carton having a first lateral section coplanar with a bottom section, a top section overlying the first lateral section and a second lateral section overlying the bottom section, the sections being joined by parallel fold line, and the method comprising drawing the bottom section vertically downwards such that the first lateral section engages a vertically inclined fixed deflector to progressively urge the first lateral section toward an upright position, and swinging a pivotable deflector from a first retracted position to a second upright position relative to the fixed deflector to engage the first lateral section and to complete the movement of that section into its upright position.

2. A method according to claim 1 in which the pivotable deflector engages the first lateral section before the first lateral section is in full contact with the inclined face of the fixed deflector.

3. A packaging machine for unfolding and erecting a flattened carton having a first lateral section coplanar with a bottom section, a top section overlying the first lateral section and a second lateral section overlying the bottom section, the sections being joined by parallel fold lines, and the machine comprising means for drawing the bottom section vertically downwards, a fixed vertically inclined deflector arranged to engage the first lateral section during the descent of the bottom section and to progressively urge the first lateral section toward an upright position, and a further deflector pivotable from a retracted position to an upright position closely adjacent the path of descent of the fold line linking the bottom section with the first lateral section whereby movement of the further deflector from its retracted position to its upright position engages the first lateral section to complete the erection of the carton.

4. A packaging machine according to claim 3 further comprising a hopper for retaining a stack of the flattened cartons, the draw-down means comprising a vertically reciprocable suction device engageable with the bottom section of the lowermost carton of the stack.

5. A machine according to claim 4 wherein the fixed deflector comprises a ramp and the movable deflector comprises an adjacent member pivotable about an axis parallel with the said fold lines, the movement of the pivotable member being synchronised with the movement of the suction device.

6. A machine according to claim 5 in which the pivotable member comprises two parallel arms flanking the ramp.

7. A machine according to claim 5 or claim 6 in which the synchronising means comprises common drive means with a pair of co-rotating cams.

8. A machine according to any one of the claims 3 to 7 further comprising pressure sensitive means coupled with the suction device and enabled during a descent thereof for detecting a possible absence of an engaged carton.

9. A machine according to any one of the claims 4 to 8 wherein each carton has an end section integral and coplanar with one of the overlying sections thereof so as to occupy a position remote from the bottom and first lateral sections in the unfolded state, the machine further comprising photo-sensing means aligned with the unfolded position of the end section and enabled during a descent of the suction device for detecting a possible failure of an engaged carton to unfold.

10. A machine according to any one of the claims 4 to 9 wherein the fixed deflector further comprises a pair of aligned horizontal rods parallel with the said axis and bracketing the top of the ramp with clearance for the pivotable deflector member.

11. A method according to claim 1 and substantially as herein described with reference to the accompanying drawings.

12. A packaging machine according to claim 3 and substantially as herein described with reference to the accompanying drawings.

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